Special Circular 25 August, 1929

HIGHER QUALITY WHEAT

WHY AND HOW

THE DEPARTMENT OF AGRONOMY
Ohio Agricultural Experiment Station

THE DEPARTMENT OF FARM CROPS
The Ohio State University

OHIO AGRICULTURAL EXPERIMENT STATION
WOOSTER, OHIO

Variety Testing Field, Ohio Agricultural Experiment Station

HIGHER QUALITY WHEAT

WHY AND HOW

Ohio can grow a superior quality of soft winter wheat. Soil and climatic conditions over a large part of the State are well suited to the crop. With the buyers of soft wheat Ohio has an enviable reputation since no other similar sized area produces as much pure soft wheat of uniformly good quality. However, the quality of Ohio's wheat appears good, partly because of contrast with the badly mixed wheat from most other soft wheat producing areas. There still exists a real need for improving the quality of wheat grown in certain regions and especially on many individual farms in the State.

MARKET DEMANDS UNIFORMITY

The big problem of the miller is to produce a flour of uniform quality. A brand of flour to be successful commercially must be the same year after year, every barrel just like every other barrel, so that the baker by using a standardized formula and method can produce a uniform product. The greatest aid to accomplishing this is to grow only varieties of wheat of known high quality in definite regions.

It is true that the quality of a single variety of wheat varies in different seasons and is somewhat affected by differences in soil, but the fluctuations in quality of flour are increased when varieties of widely different quality are grown in the same region. Some varieties seem to be more affected in quality by fluctuations of soil and season than other varieties.

Some misgiving has existed in the minds of farmers and of millers as to the probable future of the soft wheat market. Some have advocated shifting to the production of harder wheat in order to compete with hard winter and hard spring wheats in the bread flour market. This appears to be unsound reasoning. A study of the wheat market for the last fifteen years shows that soft wheat has normally sold at a premium over hard wheat of equal grade. This is the best index of market demand. The two kinds of wheat serve different purposes and to a large degree are not competitive. Soft wheat is used largely by the cracker, pastry, and special product trades and for blending with hard wheats to make general purpose flour.

There seems to be no great danger of a serious over-production of good quality soft wheat, since the producing area is restricted. It is also fairly clear that the soft wheat district could not if it tried, compete economically with the Great Plains states and western Canada in the production of hard wheat, either in quality or cost of production.

The greatest menace to the soft wheat market lies in allowing the quality of the wheat to deteriorate. The softer grades of hard wheat can be substituted for soft wheat tho the quality of the product is inferior. If thru growing soft wheat varieties of mediocre or poor quality, or by growing mixed hard and soft wheat in Ohio, quality is allowed to decline, the users of flour will promptly turn to the cheaper substitutes because of no great difference in quality. The premium for soft wheat will then permanently disappear.

FARMER'S WHEAT TO BE BOUGHT ON GRADE

In the past the milling industry has not been organized in such a way that the producer of quality wheat could be properly rewarded. The millers now realize that only by substantial cooperation on their part can wheat improvement be accomplished in a large way. The farmer who grows quality wheat should have a better price than his neighbors receive for their poorer wheat, yet this basis of buying has not been generally used.

The Tri-state Soft Wheat Improvement Association.—Millers of the three states, Indiana, Michigan, and Ohio, have formed an association that is working in close cooperation with the experiment stations of the three states. The purpose is to aid and encourage the farmer to produce high quality wheat. This association has recently adopted a schedule of minimum premiums and discounts which the individual millers have agreed to follow in their bidding. This schedule sets up minimum differentials between the prices paid for different grades of wheat and has been worked out to conform as nearly as possible with actual value differences to the miller. A copy of this premium and discount schedule is shown on the center pages of this circular.

It is recognized that the local elevator will play an important part in the wheat improvement program. Many elevators have already indicated their desire to cooperate. Such elevators will be expected to handle the recommended variety of seed wheat and will do all possible to secure the planting of a large acreage of that variety in the community. The cooperating elevators also agree to

buy wheat on the basis of its quality, and as nearly as possible on the basis of the premium and discount sheet adopted by the Tri-State Association.

Premiums and discounts reward quality.—It will be observed that there may be a considerable range in price on the same market, depending on the quality of the wheat. Since market quotations are customarily based on No. 2 red winter wheat there is no premium nor discount for No. 2.

It would probably be better psychology for the miller or the country elevator to base his bids for wheat, or the price at which he will buy wheat, on the lowest possible grade and make all better grades premiums. However, as regards the final price paid to the farmer there would be no difference. For purely practical reasons, because the great majority of wheat raised is No. 2 grade, the bid basis is for No. 2 wheat, and consequently by making the price on that grade, there is less need for any change of price. As a matter of fact, within certain variables the price actually paid to the farmer for wheat in the United States is finally fixed by the world supply and demand relationship. This price is best reflected by the Chicago option market prices. The Ohio farmer's price, relative to the Chicago option prices, is fixed primarily by the supply of soft red winter wheat in relationship to the world supplies of wheat.

The matter then of a spread in price due to quality, whether that spread be indicated by premiums or discounts, does not actually affect the price per bushel that the farmer gets otherwise than the spread because of quality. As, for example, during the first few months of the crop year of 1928, soft red winter wheat commanded a premium at Toledo of as much as 30 cents per bushel over the nearby month Chicago option price of wheat. During that period the spread in value because of quality, which spread is indicated by the Premium and Discount sheet, is identical with the basis that exists at the present crop movement when, because of the relatively high percentage of soft red winter wheat, it is now being sold at a basis of as much as 10 cents discount under the nearby month Chicago option price.

It will, therefore, be seen that with the spread in price relationship between the cash wheat in Ohio and the Chicago option of 40 cents per bushel, the range, because of the quality, can be maintained. It therefore should be the aim of the farmer to secure, by growing good quality wheat, the top price which is always a No. 1 grade regardless of whether No. 2 red wheat is selling at a premium

over the Chicago option or selling at a discount under the Chicago option. In either event he is a gainer by raising good quality wheat.

Grain dealers who buy grain by kind irrespective of quality discourage the farmer who is striving to produce grain of high quality. Such practice by the grain dealer likewise often results in loss to him when his grain is graded at the terminal market by a licensed inspector. Success will come to the elevator operator who grades all purchases just as rigidly as his shipments are graded at destination. Federal grain supervision will hold grain grading demonstrations thruout Ohio this fall in an effort to interest and instruct country shippers in the accurate grading of the grain offered at their stations. With this knowledge of grading the dealer will then be able to buy by quality, thereby encouraging farmer patrons in the production of better grains.

Moisture.—The maximum moisture content allowed for No. 2 wheat is 14 percent. On greater amounts of moisture in any wheat there is a discount in accordance with the increase in moisture content over 14 percent. This discount is made because the miller finds that if the wheat has moisture in it over that amount, he cannot add water in the tempering process of milling. Or if he mills the higher moisture content wheat, there is a greater shrinkage in the flour and mill feed produced as against the wheat used. Also the baker using flour from high moisture wheat cannot get as much water into the flour in making up doughs and consequently is the loser. Therefore the discount for increased moisture is about in proportion to the increase in percentage of water until the moisture content reaches the point where there is danger of deterioration of wheat on account of the water contained. Then the discount imposes a penalty in excess of actual value differences, due to the danger of the wheat going out of condition.

Test weight.—Discounts are made on account of test weight per bushel, because the miller finds that on lighter test weight wheats he obtains less flour per bushel of wheat than on heavier wheats. Consequently the discount on account of test weight varies according to the loss in yield of flour, up to the point where light test weights begin to affect the quality of flour directly in a noticeable degree, at which point the discount becomes greater per half pound of test weight to act as a penalty against poorer quality.

Damaged grain other than heat damaged.—Over and above the discounts on account of high moisture and low test weight, there is a discount for damaged grains of 1 cent for each percent or

fraction of a percent in excess of 4 percent. The reason for this is that No. 2 grade, according to Federal standards, allows 4 percent of damage, and consequently there can be no discount as long as the wheat grades No. 2, which is according to custom. Damaged grains, other than heat damaged, are grains that are sprouted, blighted, immature, frosty, scabby, black-tipped, injured by fungus or weevil, or grains that are otherwise not healthy, largely due to the manner in which the grain has been handled.

Heat damaged grain.—This refers to wheat that has been distinctly discolored by heat caused by fermentation or fire. It carries a variable discount, depending upon individual cases. Heat damage is a serious matter and may ruin wheat for milling purposes.

Smut.—For smut there is an additional discount of from two to ten cents a bushel, depending upon how badly smutty. This, of course, can be almost entirely controlled by the proper treating of seed wheat.

Foreign material.—There is a discount for foreign material and other grains, such as rye and cockle, of 1 cent for each percent. This is largely a matter of not getting pure seed.

Mixed wheat.—When wheat of other classes, such as hard red winter, spring, or white, is present in excess of 10 percent there is a further discount for mixed wheat of at least two cents per bushel under straight grades. Pure varieties will, of course, escape this discount.

Mold.—For mold the discounts often are quite high because musty wheat is damaged beyond repair.

The reasons for these discounts, from the miller's viewpoint, are purely practical reasons, but the effect of purchasing wheat with a range of price as indicated by this sheet is to pay the farmer who raises good quality wheat a greater price than his neighbor who does not properly care for his wheat.

PRODUCING HIGH QUALITY WHEAT

Improved varieties.—The study of methods of improving both the acre yield and the quality of Ohio's wheat has been a major project of the Ohio Agricultural Experiment Station since its beginning. We know better than ever before what cultural practices give best results. Superior new varieties, chief of which are Trumbull and Fulhio, have been bred and distributed to growers. If we may trust the results of more than a thousand tests made in many parts of Ohio these two varieties have added about three

bushels an acre to the yields of more than half the wheat fields of the State. These varieties also produce an excellent quality of soft wheat that is entirely satisfactory to the trade. Of course, it is recognized that both yield and quality are greatly affected by the weather and will vary from season to season. No variety will insure a high quality crop every year, but a good variety helps.

The strong points of *Trumbull* are stiffness of straw; early maturity; freedom from loose smut; comparative freedom from stinking smut (bunt) and from scab; non-shattering of grain; high quality of grain and flour; and good average yields. Its chief weak point is a tendency to winter kill in unfavorable situations, where drainage is poor and when seeded late on thin land. However, winter injury can be reduced very materially by timely seeding and by the use of liberal amounts of commercial fertilizer or manure on the spots in the field where winter injury is likely to take place.

Fulhio is somewhat more winter hardy than Trumbull, stools better, and can be grown successfully where Trumbull winter kills. Its average yield is a little higher than Trumbull. In time of maturity, non-shattering of grain, and quality of grain and flour, it is equal to the Trumbull. Its resistance to disease is a little lower, and its straw is a little weaker than Trumbull.

New varieties of wheat now being developed in Ohio by the plant breeders of the Station and College will need to show definite superiority to Trumbull and Fulhio in yield and quality before they will be distributed commercially. Such new varieties will first be given thoro trial in various sections of the State to determine their adaptation to soil and climate, especially as regards uniformity in milling quality.

Pure seed.—It is important to keep seed wheat reasonably free from mixtures with other varieties. To do this requires special care at threshing time. If a custom threshing machine is used it should be cleaned out by running empty for a while. Even then the first 15 bushels to come thru should not be used for seed. A good plan is to thresh oats or barley ahead of the wheat. The best way to avoid mixing varieties is for the entire community to grow the same variety.

A good way to get started with a pure seed is to buy certified seed. The next best is to buy good uncertified seed that came from recently certified seed. It should be as free as possible from noxious weeds and variety mixtures. Such seed can be obtained thru the elevators that cooperate with the Association.

To maintain a high degree of purity, it is necessary to rogue at least part of a field for seed purposes, going thru before harvest to remove all off type heads of wheat and all cockle, cheat, and other weeds. The rogued area should then be threshed with special care and saved for seed.

Seed treatment for smut.—Stinking smut or bunt is controlled by treating the seed with two or three ounces of copper carbonate dust to a bushel of wheat. The wheat should first be thoroly cleaned with a fanning mill to remove smut balls. Every kernel must be coated with the dust. This is best done by mixing the grain and dust in a tight mixer of some sort. Shoveling the grain over several times does not coat the seeds completely enough.

A cheap homemade mixer resembling a barrel churn can be made by passing a three-fourths inch pipe diagonally thru an oil drum or a wooden barrel which should be welded or bolted to the pipe. A crank is made of 2 elbows and two short pieces of pipe and an opening made in the barrel with a hinged door that clamps down dust tight. Mount the mixer on saw horses. As copper carbonate dust is poisonous a mask should be worn when treating seed and the work should be done in an airy place. Copper carbonate is a fine dust that sifts into the bearings of the drill. After the drill has stood over night the feed shaft should be turned with a wrench to free it and prevent breaking or twisting the parts. Do not use treated seed for food or allow animals to eat it. Copper carbonate does not affect germination of the wheat.

How increase test weight?—Light test weight of wheat may be caused by unfavorable weather conditions at filling time, by rust and scab, by insufficient soil fertility, or an unbalanced condition in which nitrogen is excessive. Lodged grain is also likely to be light and shriveled. Very late planting is also unfavorable to high quality as measured by test weight. Weather conditions are beyond the control of the farmer but some of the other factors that influence test weight can be partly controlled.

Rust and scab are diseases which depend somewhat on favorable weather conditions for their development. Black stem rust is frequently a serious disease in northwestern Ohio. It is carried over on plants of the common barberry. Eradication of its host plant, the common barberry, is helping to reduce black stem rust in Ohio. Leaf rust is common on wheat all over the State. It does very little damage. Wheat scab is much worse on wheat following corn than following other crops. It is prevalent in southwestern

Ohio where the common practice is to follow corn with wheat. Changing the rotation so that wheat does not follow corn will reduce the infection.

Lodging can be reduced by growing a stiff strawed variety. On rich land where a heavy growth of straw is favored, cutting down the rate of seeding to 5 or 6 pecks per acre will reduce the amount of ledging.

A twenty-year test at Wooster shows that wheat planted at two-week intervals after the optimum date, the 3d week in September, gradually decreased in test weight; that planted the 3d week in October testing three pounds less.

Fortunately, there is a marked correlation between high yield and high test weight. Cultural and fertilizer practices that favor high yields also favor high quality. In a fertilizer experiment at Wooster, wheat receiving regularly 500 pounds per acre of a 2-12-2 fertilizer has shown an 11-year average test weight of 59.9 pounds compared to 57.6 pounds for wheat on adjacent unfertilized land.

Better fertilizer practice.—Wheat responds profitably to generous applications of high grade fertilizers on practically all soils in the State. In the following table are given recommendations as to analysis and rate of application for various soil conditions.

Fertilizer Recommendations for Wheat

Kind of soil	Manured or clovered		Neither	
	Analysis	Amount	Analysis	Amount
		Lb.		*Lb.*
Light colored silt loams, clay loams, and clays	0—20—0	300—400	2—14—4	300—400
Light colored sandy soils	2—14—4	300—400	4—12—4	300—400
Dark colored silt loams, clay loams, and clays	0—20—0	250—350	0—14— 6	200—350
Mucks and peats	0—14—6	250—300	0—12—12	200—350

On light colored unmanured land, an application of 100 pounds per acre of nitrate of soda or its equivalent of other readily available nitrogen fertilizer is suggested as early in the spring as soil conditions permit.

Care in harvesting and threshing.—Poor shocking is responsible for much damaged wheat. A well built shock made of eight or nine sheaves and with a well placed cap will stand erect and undamaged thru a spell of wet weather that will badly spoil a poorly built shock.

Threshing while the grain is damp is a frequent cause of low grade. Wheat containing more than 14 percent of moisture is unsafe in storage. Damp grain is sure to heat and spoil in storage unless a means of artificial drying is available.

If the combined harvester is to be used, the best way is to estimate when the standing grain is dry enough. Then thresh out about a quart sample of wheat by hand, put it in an air-tight can and take it to an elevator where a moisture tester is available. The sample should not be taken before about eleven o'clock. Tests have shown that dry standing wheat absorbs dew or rain sometimes up to 20 percent or even more and seldom dries down to 14 percent before 10:30 a. m., sometimes not until after eleven o'clock. Moisture tests may need to be made for several days before the wheat reaches the safely point of 14 percent.

Care in storage.—Weevils can be extremely destructive to stored wheat. The best means of destroying them on farms is carbon bisulfide. This is a liquid that can be bought at any drug store in tightly sealed cans. It evaporates quickly into a vapor that is heavier than air. The vapor sinks into the air spaces among the grain, displaces the air and kills all insects with which it comes in contact. The vapor is inflammable and explosive when mixed with air, and all fires must be kept away.

Where the amount of grain in the bin is known allow 1 pound of carbon bisulfide for each 30 bushels plus 1 pound for each 200 cubic feet of space above the grain. Where the amount of grain is unknown allow 8 pounds of the liquid for each 1,000 cubic feet of space in the bin including grain and air space above.

Seal all cracks in the wall with wet newspaper or other air-tight seal, close all doors with canvas or boards, and close the outside door tightly during fumigation.

For grain not more than 3 feet deep the carbon bisulfide may be sprinkled over the surface of the grain. For deeper grain a pipe with a screen over the lower end should be shoved deep into the grain and the liquid poured in at intervals about the bin. The bin should be kept closed tightly for 36 hours, and a longer time will not injure the food value or germination of the grain.

Carbon bisulfide fumigation is successful only when the temperature is above 67° Fahrenheit.

The following publications of interest to wheat growers will be mailed free of charge upon request:

THE OHIO STATE UNIVERSITY, AGRICULTURAL EXTENSION SERVICE, COLUMBUS, OHIO

"Wheat Growing in Ohio"—Bul. No. 81. 1928-29.

"Stop the Leaks in Grain"—Crop Talk No. 24.

"The Combined Harvester-Thresher in Ohio in 1928"—Mimeograph Bul. No. 18. Dept. of Rural Economics.

THE OHIO AGRICULTURAL EXPERIMENT STATION, WOOSTER, OHIO

"Dust Treatment for the Control of Stinking Smut in Wheat"—Bimonthly Bul. Sept.-Oct., 1929.

"Fertilizers for Wheat"—Bimonthly Bul. Sept.-Oct., 1926.

"Trumbull and Fulhio Wheat Best for Ohio Farms"—Bimonthly Bul. Sept.-Oct., 1926.

"Control of Smuts of Wheat and Oats With Special Reference to Dust Treatment"—Bul. 390. 1925.

"Field Work of the Ohio Agricultural Experiment Station".

"The Use of the Standard Ratio Fertilizers"—Feb. 1929.

THE OHIO SEED IMPROVEMENT ASSOCIATION, COLUMBUS, OHIO

"Seed Wheat, Certified and Registered".

"Rules and Regulations of the Ohio Seed Improvement Association".

"List of Growers of Certified and Registered Seed Wheat".

TRI-STATE SOFT WHEAT IMPROVEMENT ASSOCIATION

PHONE TAYLOR 3492
2221 FRONT STREET - - - TOLEDO, OHIO
MARIE LEMBERGER, Secretary

MINIMUM
PREMIUM AND DISCOUNT SHEET
JULY 1, 1929

Mr. Shipper:—

The proper discounts for poor wheat merely mean good premiums for good wheat. The spread in price between good and inferior wheat of the same class is really not a price proposition, but a wheat improvement program. The price in general is determined by supply and demand, but the spread in price between different qualities of wheat can be more or less fixed for the benefit of the whole trade.

It is much to your interest, and also to the farmer's interest to pass the following basis of premiums and discounts on to the farmer in buying his wheat. Indeed, you should add at least an additional 2c per bushel discount because of most shippers' cramped facilities as compared to terminal market facilities for separating grades.

Such a program carried out, will aid the farmer to improve his quality of wheat to get the top of the price fixed by supply and demand.

We ask your cooperation for the benefit of the whole trade.

Grade		No. 1		No. 2		No. 3				No. 4				No. 5					
	Test Weight	61	60	59	58	57½	57	56½	56	55½	55	54½	54	53½	53	52½	52	51½	51
	Moisture 12.	1	1	0	0	0	-½	-1	-1½	-2½	-3½	-5	-6½	-8½	-10½	-12½	-14½	-16½	-18½
No. 1	12.5	1	1	0	0	-½	-1	-1½	-2	-3	-4	-5½	-7	-9	-11	-13	-15	-17	-19
	13.	1	1	0	0	-1	-1½	-2	-2½	-3½	-4½	-6	-7½	-9½	-11½	-13½	-15½	-17½	-19½
	13.5	1	1	0	0	-1½	-2	-2½	-3	-4	-5	-6½	-8	-10	-12	-14	-16	-18	-20
No. 2	14.	0	0	0	0	-2	-2½	-3	-3½	-4½	-5½	-7	-8½	-10½	-12½	-14½	-16½	-18½	-20½
No. 3	14.5	-½	-1	-1½	-2	-2½	-3	-3½	-4	-5	-6	-7½	-9	-11	-13	-15	-17	-19	-21
	15.	-1½	-2	-2½	-3	-3½	-4	-4½	-5	-6	-7	-8½	-10	-12	-14	-16	-18	-20	-22
No. 4	15.5	-3	-3½	-4	-4½	-5	-5½	-6	-6½	-7½	-8½	-10	-11½	-13½	-15½	-17½	-19½	-21½	-23½
	16.	-5	-5½	-6	-6½	-7	-7½	-8	-8½	-9½	-10½	-12	-13½	-15½	-17½	-19½	-21½	-23½	-25½
Sample	16.5	-7½	-8	-8½	-9	-9½	-10	-10½	-11	-12	-13	-14½	-16	-18	-20	-22	-24	-26	-28
	17.	-10½	-11	-11½	-12	-12½	-13	-13½	-14	-15	-16	-17½	-19	-21	-23	-25	-27	-29	-31

In addition, add:—

For damaged grains—1c for each 1% or fraction in excess of 4%.
For smut—2c to 10c depending on how badly smutty.
For foreign grain such as rye—1c discount for each per cent.
For mixed wheat, minimum of 2c per bushel discount under straight grades.
For must—Depending on individual cases.
For heat damage—Depending on individual cases.

Examples:—

No. 1 wheat	60 lbs.	13.5 moisture		1c premium
No. 3 wheat	59 lbs.	14.5 moisture		1½c discount
No. 3 wheat	59 lbs.	14.5 moisture	6 % D. G.	3½c discount
No. 3 wheat	56 lbs.	14.5 moisture	5½% D. G.	6c discount
No. 4 wheat	58 lbs.	14. moisture	8 % D. G.	4c discount

Above premiums and discounts are the minimum basis for applying shipments on No. 2 wheat contracts.